DATA
Data Science

Who are we …

Abdullah Kahraman, FHNW

Christian Kronseder, FHNW

Alexandre Kuhn, HEVS

Lukas Neutsch, ZHAW

Moritz A. Kirschmann, CSEM

Presentation of our Groups

Our expertise / Competences

AI for Life Sciences lab

Data Science for Life Sciences, Computational Biology, Machine learning Methods

- Holistic analysis of omics data for precision medicine

- Analysis and prediction from multimodal data
- Learning from little data
- Explainable AI / Interpretable AI

Moritz A. Kirschmann
Bioimage analysis, multimodal AI, NLP

Tim Heinemann
Computational Biology, drug screening, predictive modelling

Jonas Meirer
Biostatistics, omics, Interpretable AI

Francesca Luongo
AI, generative methods for image analysis

Kahraman lab - Data Science for Life Sciences, Computational Structural Biology / Cancer Omics

Dr. Abdullah Kahraman, PI

Tülay Karakulak, Ph.D. Student

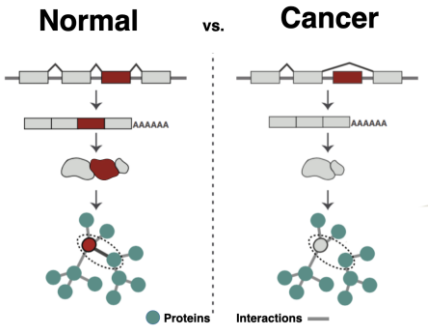
n|w

SIB Swiss Institute of Bioinformatics

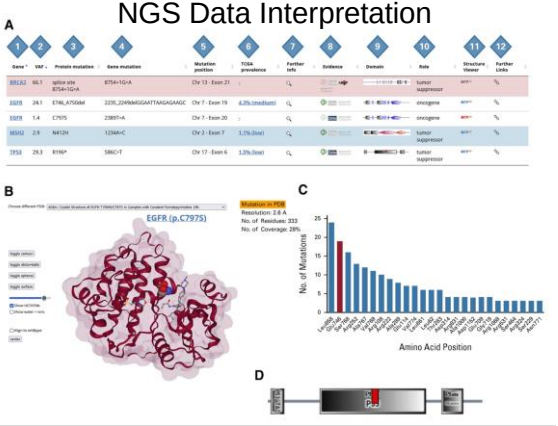
USZ Universitäts Spital Zürich

- Computational identification of new cancer and disease mechanisms for superior precision medicine

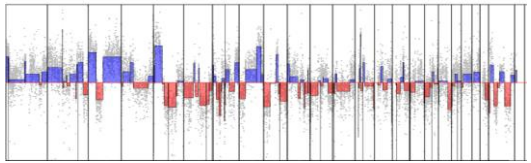
Cancer-specific Alternative Splicing Events



NGS Data Interpretation



Cancer Genomics and Diagnostics



Quantum accelerated ROSETTA modelling

Rosetta Commons

Biotechnet

Data science in biotechnology
Genomics & Bioprocess

Prof. Alexandre Kuhn

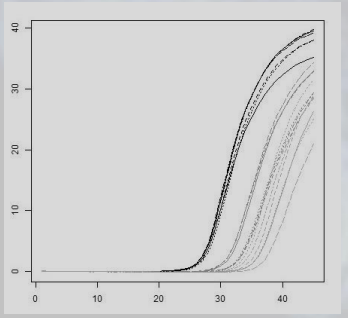
Laboratory of Molecular Biology

Institute of Life Technologies, HES-SO Valais-Wallis

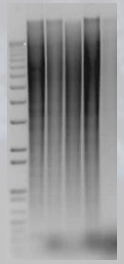
DNA sequencing is a major source of big data

High-throughput sequencer

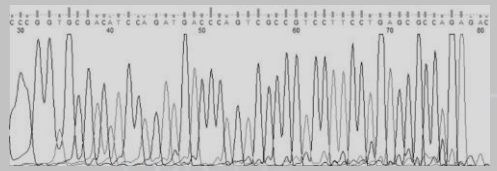
Genomic characterization can replace a heterogeneous set of conventional methods



qPCR

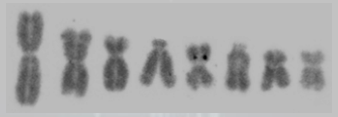


Southern blot

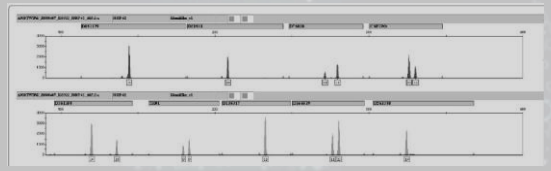


Sanger

VERSUS



FISH



STR profiling

Characterization of transgene integration site in yeast

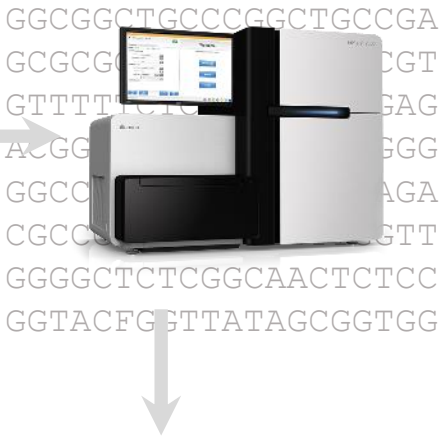
Transgene construct

Transfected cell pool

Cloning

New yeast strain

Whole genome sequencing



Promoter

Transgene

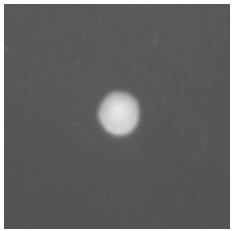
Antibiotic resistance

Transgene integration site

Limiting dilution

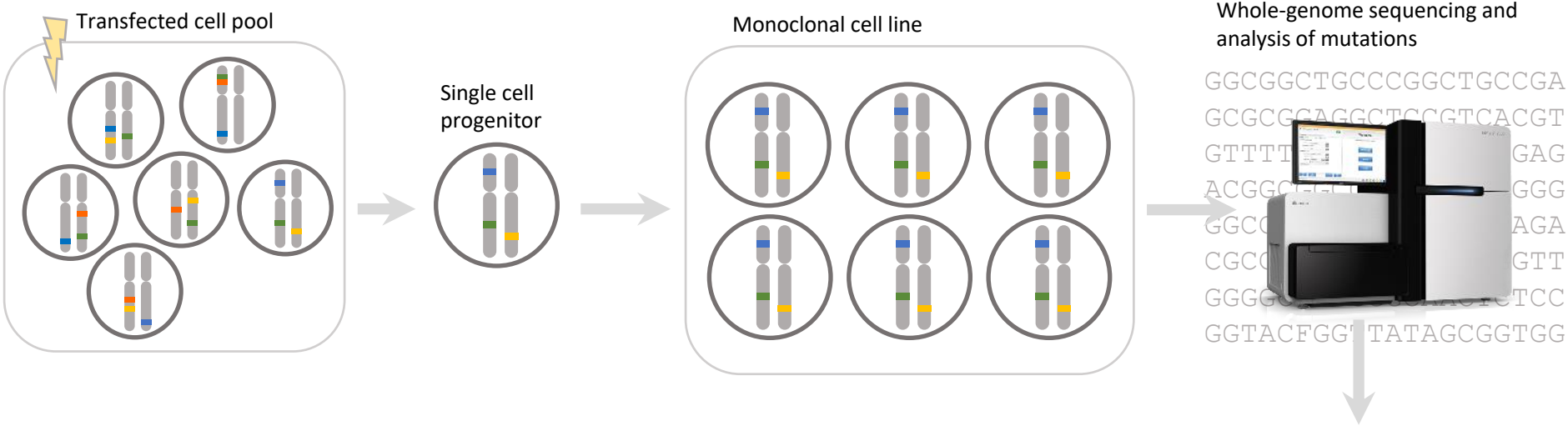
ClonePix™

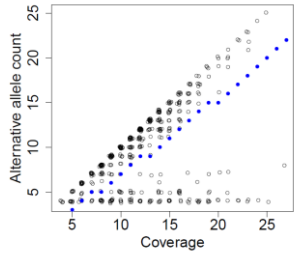
Colonies grown in semi-solid medium



Beacon™

Cell cloning determines the mutational spectrum of a cell line

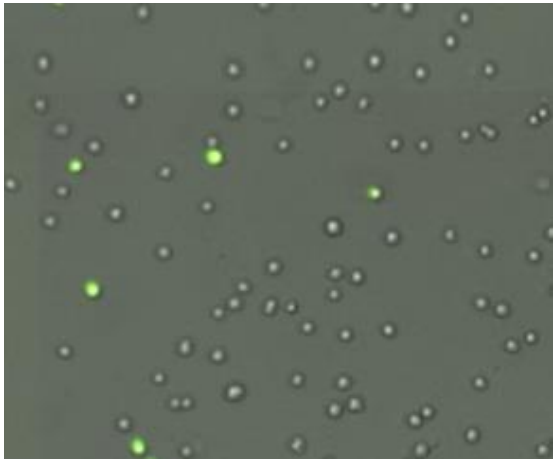


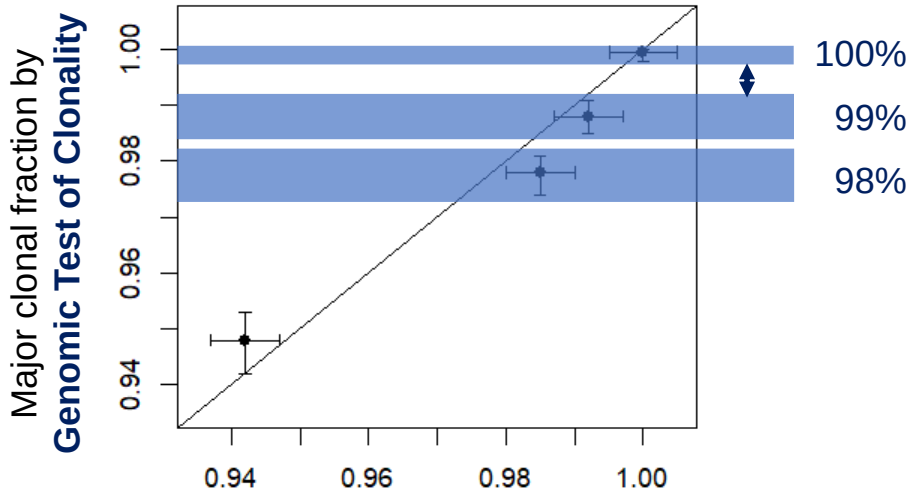


Genomic Test of Clonality

- **Parametrical** modeling of SNV distributions
- **Robust estimators** for parameter estimation
- **Confidence intervals and p-values**

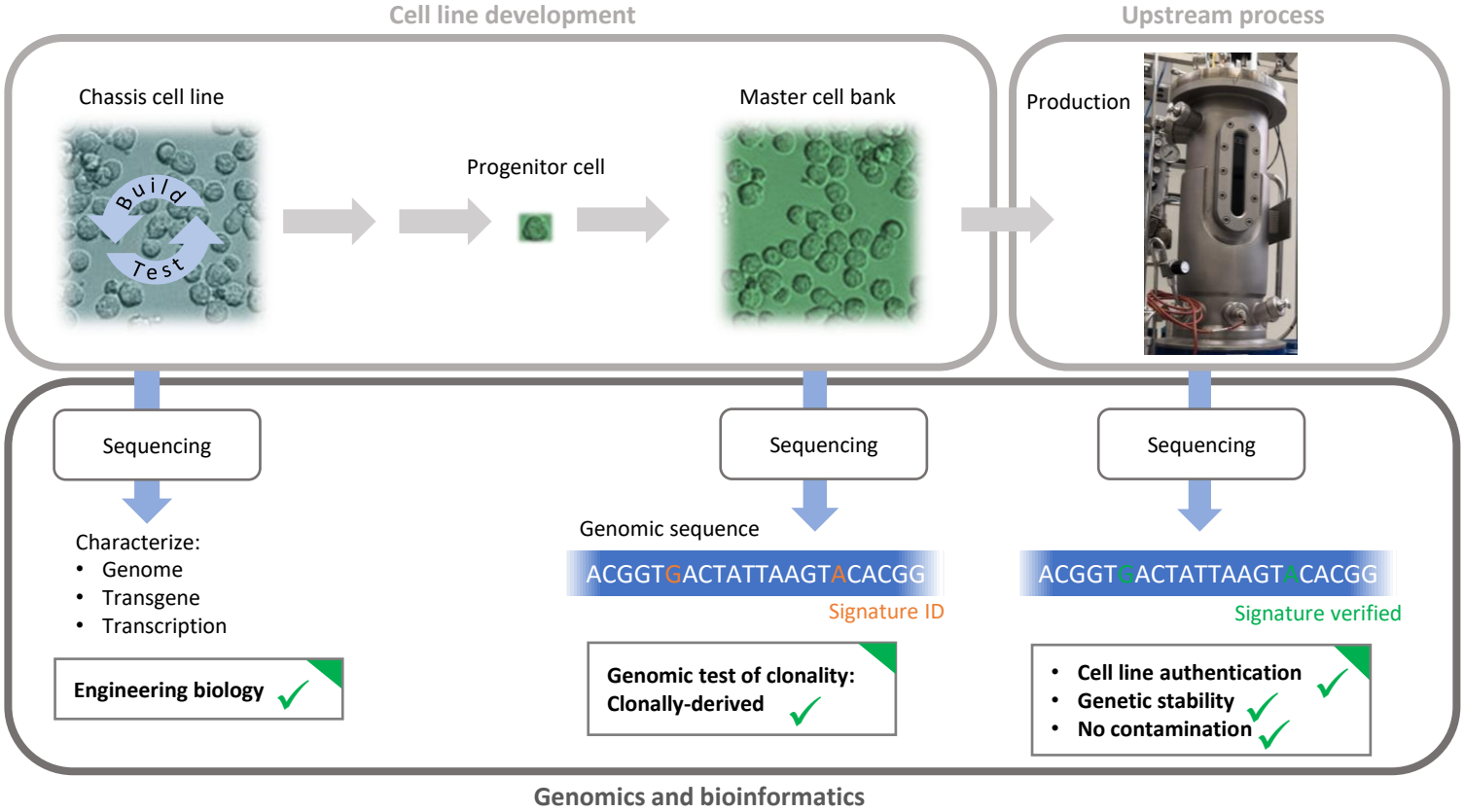
The “Genomic Test of Clonality” can detect clonal fractions of 1%





Kuhn A, Le Fourn V, Fisch I, Mermod N, Biotechnol. Bioeng. 2020

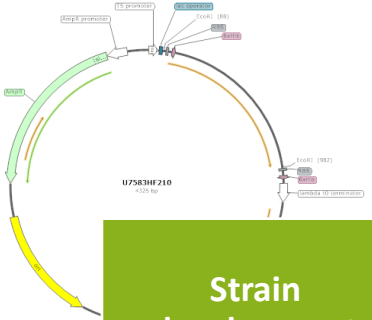
Integration of DNA sequencing into bioprocess development

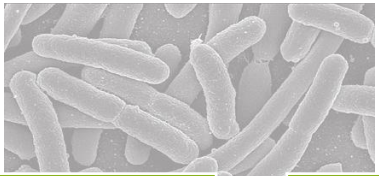


Vorlet O, Neutsch L, Kronseder C, Kuhn A. Chimia, 2021

Integrated bioprocess development platform

nattokinase production

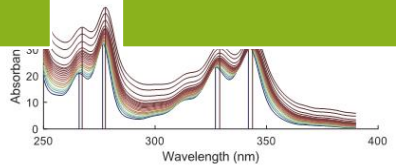


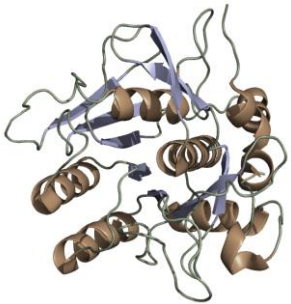


$$\frac{d\mathbf{x}(t)}{dt} = \mathbf{S} \cdot \mathbf{v}(\mathbf{x}(t), \mathbf{u}(t), \boldsymbol{\theta})$$

Strain development → Preculture → Fermentation → Lysis

Solubilization → Chromatography → Refolding





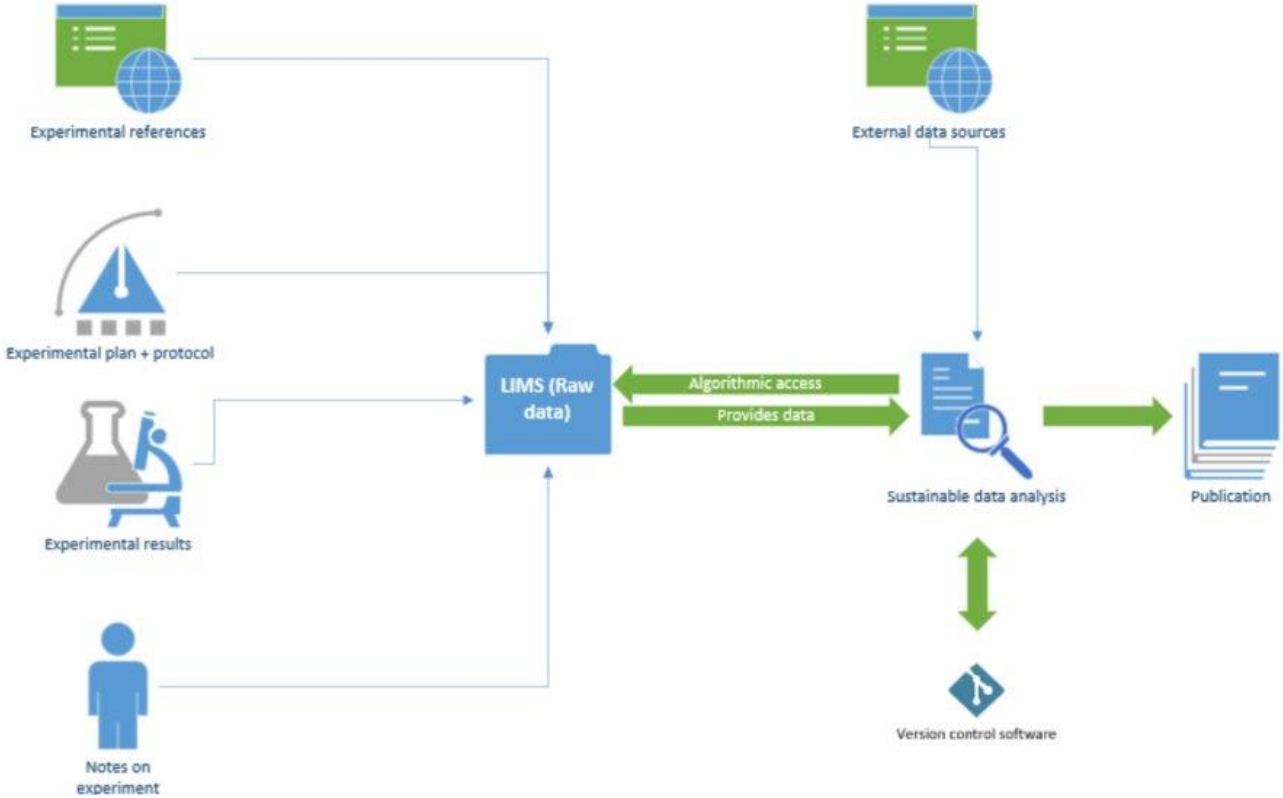
Nils Hanik

Matthias Rüdt

NextGenDMS

Data management system for iterative knowledge acquisition

Matthias Rüdt



Messages

1. DNA sequencing allows to
- Characterize transgenes
- Assess clonality
- Understand genetic stability

→ **De-risks cell line development and upstream processing**

2. New integrated platform for process development

→ **Better understanding of bioprocesses**

✉ alexandre.kuhn@hevs.ch

Acknowledgements

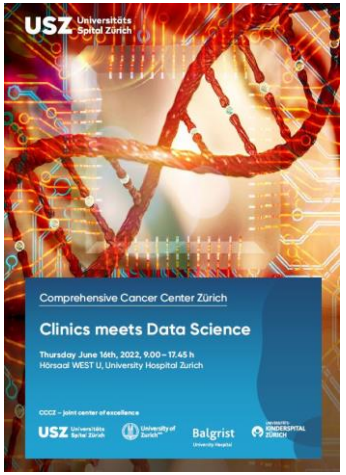
Dr. Sarah Wegmüller
Dr. Aline Adler
Gordana Pistoletti
Thibaud Peyrollaz
Nihal Mansour
Prof. Nils Hanik
Prof. Matthias Rüdt
Prof. Sergio Schmid
and many more

Expertise / facilities of the platform

- Wide range of digital life science topics
  - Clinical cancer diagnostics
  - Design of large next generation sequencing projects
  - Protein modelling and design
  - Drug development and virtual screening.
  - Bioproduction
  - Process modeling and optimization

Important events and activities 2023

- **3rd Clinics Meets Data Science symposium (08.06.2023) Hybrid Zoom meeting@USZ**
  - Clinical Data Science focusses on developing computational software and databases. Enhanced digitalization and data volume at hospitals has increased the demand Data Science in the clinics to empower data driven precision medicine. Our symposium will showcase these efforts, highlight current and future applications and developments in clinical Data Science and discuss possibilities and opportunities that Data Science offers for the clinical daily routine.



- **Industry Workshop**
  - Latest software and database developments in bioinformatics in collaboration with Swiss Institute of Bioinformatics and European Bioinformatics Institute.

SIB Swiss Institute of Bioinformatics

EMBL-EBI

What you can expect from us

Organize events and collaborations for networking between scientists interested in solving cutting-edge problems using data science-related tools.

We want you …

- If you are looking for / If you are a …
  - Bioinformatician
  - Chemoinformatician
  - Computational biologist/chemistist
  - Clinical data scientist
  - Machine learning / AI expert
  - Biostatistician
  - …